LUMBER GRADE AND VALUE PERFORMANCE of YOUNG-GROWTH PONDEROSA PINE LOGS at the CHALLENGE EXPERIMENTAL FOREST

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TECHNICAL PAPER 55
MARCH 1961

PACIFIC SOUTHWEST
FOREST AND RANGE
EXPERIMENT STATION
BERKELEY - CALIFORNIA

FOREST SERVICE - U. S. DEPARTMENT OF AGRICULTURE

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Technical Paper 55 March 1961

U. S. ~~DEPARTMENT OF AGRICULTURE~~, FOREST SERVICE,
Pacific Southwest Forest and Range Experiment Station
Berkeley ~~1~~, ~~California~~

CREDITS

The authors gratefully acknowledge assistance received from the following organizations:

Soper-Wheeler Co.
Setzer Forest Products
Western Lumber Manufacturers Assoc.
Diamond National Corp.
High Sierra Pine Mills, Inc.
California Division of Forestry
University of California

The help of many U. S. Forest Service foresters in Region 5 and at the Challenge Experimental Forest is appreciated.

A contribution of the Ponderosa Pine Section
of the
National Log Grade Project

LUMBER GRADE AND VALUE PERFORMANCE OF YOUNG-GROWTH PONDEROSA PINE LOGS AT THE CHALLENGE EXPERIMENTAL FOREST IN CALIFORNIA

By Carl A. Newport and Elliot L. Amidon

Old-growth timber is still the main source of ponderosa pine sawlogs in California, but the proportion of the annual cut from young-growth sawtimber is expected to rise rapidly in the future. The increasing significance of the young-growth resource is particularly apparent in the westside Sierra subregion, where the Challenge Experimental Forest is located. In this subregion, almost 20 percent of the annual softwood sawtimber growth on commercial forest land is in young-growth sawtimber. 1/

This paper reports a mill study of young-growth pine logs which had three main objectives:

1. To determine the total rough- and surfaced-dry lumber recovery for logs by diameter, length, and soundness. This objective is common to most mill studies. However, this report includes an error estimate with the basic lumber recovery relationships.

2. To determine the average lumber grade recovery for both rough- and surfaced-dry lumber as a percent of total lumber recovery by log diameter class and California Westside log grades. This objective, like the first, is often sought in mill recovery studies. The data are frequently used, in conjunction with lumber prices, to estimate value by log size, grade, or other categories. In this report, the grade recovery information is presented only for comparison with the product output of other studies.

3. To determine the average surfaced-dry lumber value per thousand board feet by log diameter and California Westside log grades. In this report the values developed were based on regional average lumber prices (Region 5) for 1958. The computational method used facilitates rapid calculation of new values following price changes. Equally important, the procedure provides an expression of the variability associated with the averages obtained.

In addition to these main objectives, this study provided raw data needed for future development of log grading systems for young-growth ponderosa pine.

1/ California Forest and Range Experiment Station, Forest Statistics for California, U. S. Department of Agriculture, Forest Survey Release No. 25, 1954.

FIELD DATA COLLECTION AND COMPILATION

THE LOG SAMPLE

All study logs came from the Challenge Experimental Forest, Challenge, California. Specifically, the logs were cut from an even-aged, approximately 90-year old stand which averaged 43,000 board feet per acre before harvesting. The average elevation was 2,600 feet.

The logs were hauled to the sawmill yard in 32-foot sections and bucked into mill lengths which were scaled, graded, and diagrammed. Scaling was done by the Scribner Decimal C system according to Forest Service Scaling Handbook procedures. The following data were recorded for each log:

1. Gross scale
2. Net scale
3. Defect deductions by type of defect
4. End diameters, nearest inch (inside bark)
5. Log length, including trim
6. Taper in inches per 16 feet
7. Position in the tree (butt, second, middle, and top)
8. Number of growth rings in the outer four inches of wood along the scaling diameter
9. Grade by the California Westside system
10. Location and size of knots or other surface imperfections (on diagrams)

The 501 logs selected had a total gross scale, Scribner Decimal C log rule, of 137,800 board feet. The total net scale, 136,340 board feet, was a reduction from gross scale of only 1.06 percent. The distribution of the 501 sound and defective logs chosen is shown in Table 1.

SAWING AND REMANUFACTURE

The logs were sawn by the Soper-Wheeler mill at Strawberry, California, which has a circular headsaw and a sash-gang resaw. Other equipment includes an edger, a trimsaw, and a dip tank. Several measurements determined that the kerf on the headsaw was 11/32 and on the gangsaw 4/32 of an inch. The setworks on the carriage were adjusted to cut 6/4 lumber 1 and 27/32 inches thick. The 4/4 cuts on the headsaw were set for 35/32 of an inch, and on the gangsaw for 33/32.

Detailed sawing instructions were agreed upon by the cooperators in the study before sawing the sample logs. In general, each log was sawn best face first, and the higher quality logs were turned until all four faces had been cut for select and shop lumber. The green lumber was graded by a certified Western Pine Association lumber grader (who did all subsequent grading in the study) and then separated into 6/4 and 4/4 thicknesses and hand-piled onto solid pile foundations for air drying.

After drying, the lumber was hauled to the High Sierra Pine Mills, Oroville, California, given a rough-dry grade, and sorted into piles on the basis of grade, thickness, and width. Sample piles were selected for surfacing. Within each lumber grade, the samples were drawn to represent most thicknesses and widths. The surfacing sample, 59,204 board feet, was the basis for computing factors to indicate the probable change in grade due to planing for each lumber grade. The planing was done on a 24-inch 4-head planer under the existing production conditions at a feed rate of approximately 270 linear feet per minute.

The 4/4 thickness lumber was surfaced on four sides and the 6/4 on only two sides. The distribution of the rough-dry lumber grades into surfaced-dry grades was recorded and expressed as percentages of the initial rough-dry volume for both thicknesses (Tables 2 and 3). A weighted combination of these two tables was used to convert the rough-dry volume by lumber grade for each log into surfaced-dry lumber volume by grade. The actual conversion was made by an IBM 650 data processing machine. 2/

RESULTS

ESTIMATING TOTAL LUMBER RECOVERY

Total lumber recovery for logs of given diameter and length is presented in actual and estimated (curved) form in Tables 4 and 5. From these tables it is possible to compute overrun on the basis of any log-scaling system one chooses to use.

The Scribner Decimal C log rule, which is often used regionally, was selected as the basis for computing overrun percentages for each scaling diameter in Tables 4 and 5. Overrun is frequently presented as a smooth curve calculated from percent overrun data for individual logs. This curving procedure is faulty when the log scale basis for the percent overrun calculation is not a curve itself, as in the case of the Scribner Decimal C diagram-based rule. Therefore, the procedure adopted for this study was to calculate curves of lumber volume recovery before making a comparison with the Scribner Decimal C log rule.

The two curves were based on sound, 16-foot logs only. This was not a severe limitation since 90 percent of the sample logs fell into this category. Several curve forms were tested. The final regression for rough-dry volume was $Y = -8.866 + 1.687X + 0.6245X^2$, where Y equals volume in board feet and X equals log scaling diameter in inches. The range in diameter was from 6 to 36 inches, the standard deviation from regression ($S_{y \cdot x}$) was 22 board feet, and the coefficient of determination

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2/ Newport, Carl A. and Joe Leach, "A method for the application of change in grade factors to individual logs--an IBM 650 program," Pacific Southwest Forest and Range Experiment Station, Technical Paper No. 41, 1959.

(R^2) was 0.98. The final regression for surfaced-dry volume on diameter is $Y = -3.328 + 0.6792X + 0.6456X^2$, where Y, X, the diameter range, and R^2 are the same as for the rough-dry equation, but the standard deviation from regression is slightly less, 21 board feet. Table 5 shows the regression estimates of the rough- and surfaced-dry volume per log and percent overrun for each scaling diameter.

ESTIMATING LUMBER GRADE RECOVERY

The rough-dry lumber grade recovery percentages are presented in Table 6. Sound and defective logs were combined because there was no indication in this study that defective logs produced a different grade recovery than sound logs. The surfaced-dry lumber grade recovery is presented in Table 7. The change in lumber grade from the rough- to surfaced-dry condition was determined from surfacing samples by the procedure mentioned earlier. The two tables, both based on 500 logs, were developed from the data within each grade and diameter class. No curving was done to obtain these average percents.

Lumber grade recovery tables of this type are often multiplied by lumber prices to obtain value estimates. If this method is followed then no concise measure of statistical reliability can be attached to the value estimates. For this reason the grade recovery tables are presented only for comparison with similar recovery tables in other mill-study reports.

ESTIMATING AVERAGE LUMBER VALUE PER THOUSAND BOARD FEET

A new method was used to estimate value performance with an associated statement of reliability. The first step was the calculation of the value per thousand board feet lumber tally for each log (sound or defective) in the mill study. These calculated log values were then used as individual observations in regression calculations of log value per thousand board feet on diameter for each log grade. With this method, the variation in the sample is not removed arbitrarily as is the case when prices are applied to average recovery percentages. Fortunately, the computational work involved in computing individual log values and regressions based on them with each new change in lumber prices has been reduced greatly by means of electronic computers and regressions programs.

Several forms of regression equations using average lumber value per thousand board feet as the dependent variable and diameter as the independent variable were tested to select the one with the best fit. The final regressions were:

1.	Log Grade II (29 observations)	$Y = -205.2 + 20.28X - 0.3195X^2$ $S_{y \cdot x} = \$12.36$ $R^2 = 0.46$
2.	Log Grade III (147 observations)	$Y = 75.08 - 0.5928X + 0.0479X^2$ $S_{y \cdot x} = \$11.03$ $R^2 = 0.32$

3. Log Grade IV (324 observations) $Y = 75.91 - 0.7554X + 0.047X^2$ $S_{y \cdot x} = \$10.07$ $R^2 = 0.32$

In each of these equations Y equals dollars per thousand board feet lumber tally and X equals log scaling diameter inside bark in inches. The following regional average lumber prices for calendar year 1958, as determined by Region 5 of the U. S. Forest Service, were used in the computations:

Lumber grade	Prices (Dollars)
B and better	252.87
C select	243.12
D select	165.73
Moulding	163.76
No. 3 clear	120.65
1 shop 1/	112.96
2 shop	91.24
3 shop	62.07
1 and 2 common	106.78
3 common	69.68
4 common	52.46
5 common	33.05

1/ Includes 4/4 lumber.

New equations can easily be computed for any other set of lumber price data by use of electronic data processing equipment for which programs are available.

These three regressions are plotted in Figures 1, 2, and 3 for the range of scaling diameters encountered in the mill study. The value of each log is plotted to show the variation in the sample. Note that the regression for Grade II is based on only 29 logs. It is possible that with a larger sample the regression line might have curved upward like the regressions for Grades III and IV. A comparison of these regressions shows that the absolute difference between Grades III and IV is less than $3.00 per thousand board feet for log diameters of about 20 inches or less. These figures help the appraiser to decide, for his particular circumstance, whether the increased accuracy resulting from separate use of these regressions justifies the additional log grading costs involved.

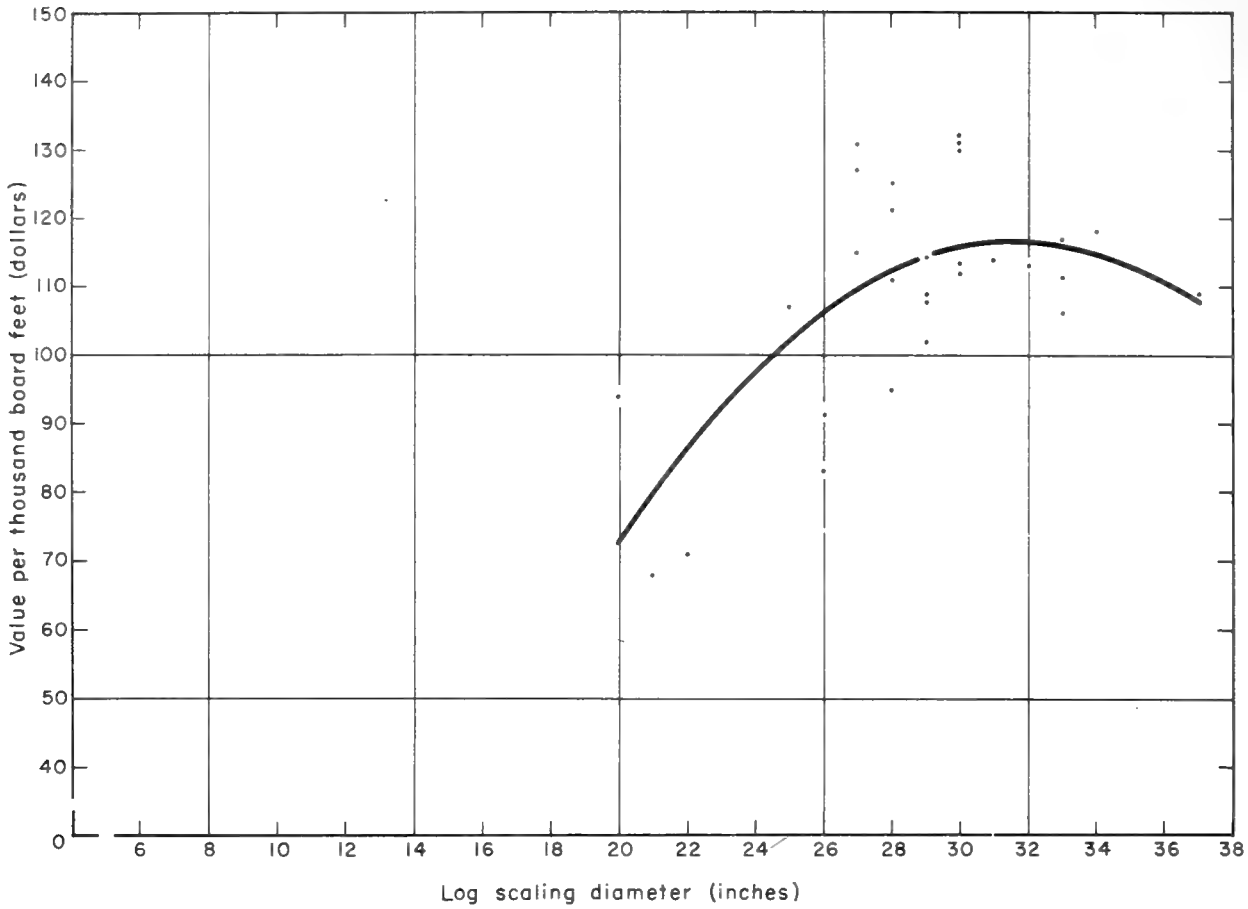

Figure 1.--Value per thousand board feet for California Westside Log Grade II.

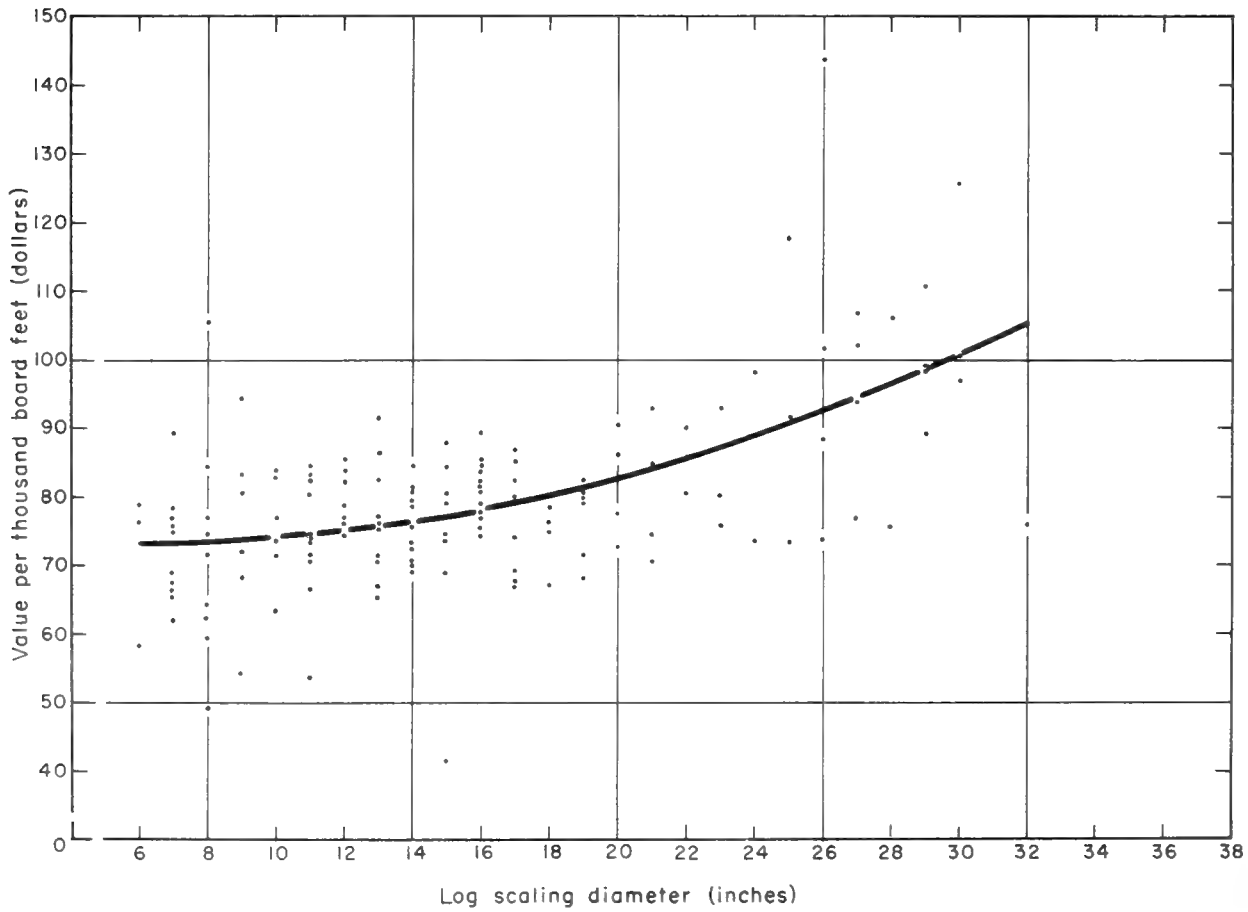

Figure 2.--Value per thousand board feet for California Westside Log Grade III.

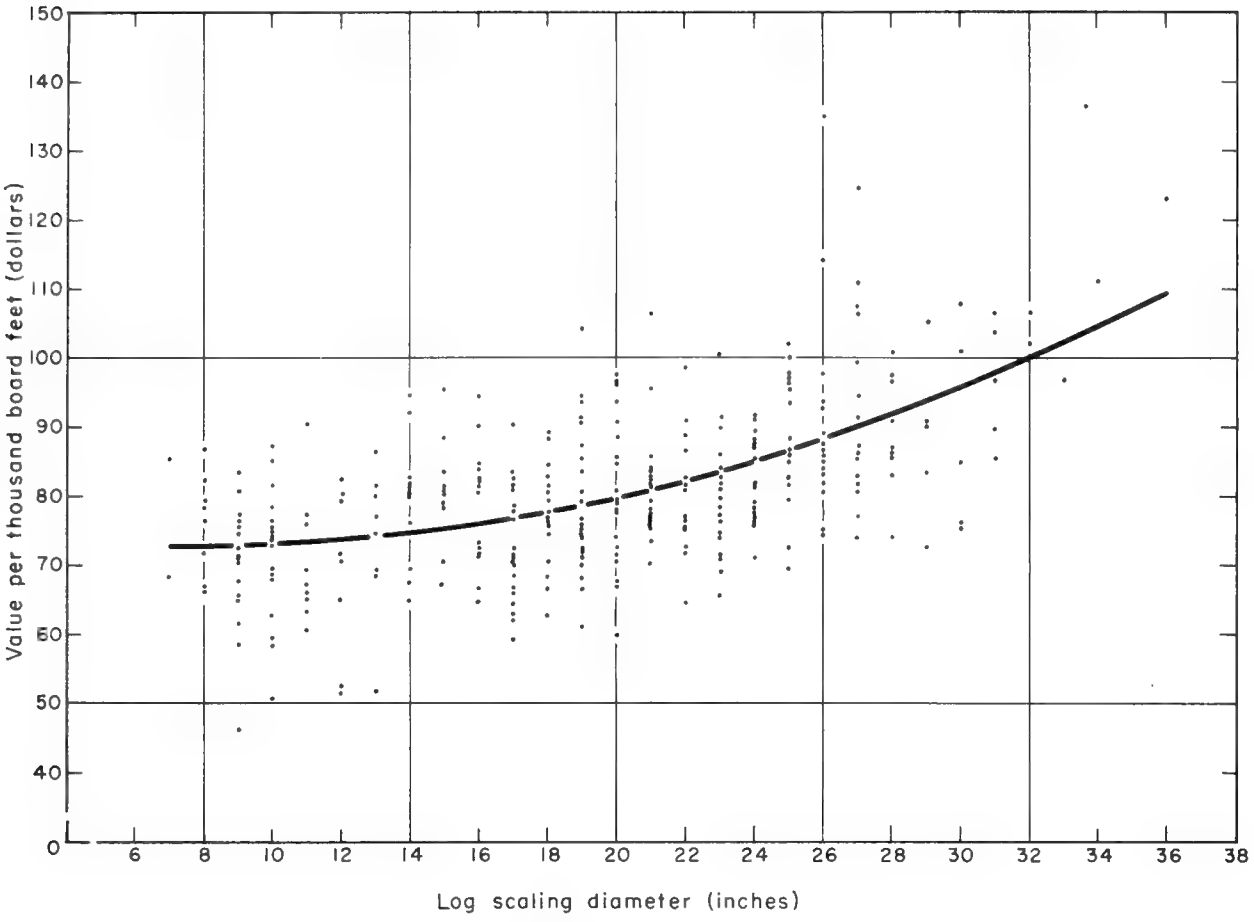

Figure 3.--Value per thousand board feet for California Westside Log Grade IV.

Table 1.--Distribution of logs by diameter, California Westside log grade (field), soundness and length

Log scaling diameter, inches	Log grade II				Log grade III				Log grade IV				All logs 1/			
	Sound		Defective		Sound		Defective		Sound		Defective		Sound		Defective	
	12&14 ft.	16 ft.	12&14 ft.	16 ft.	12&14 ft.	16 ft.	12&14 ft.	16 ft.	12&14 ft.	16 ft.	12&14 ft.	16 ft.	12&14 ft.	16 ft.	12&14 ft.	16 ft.
	Number															
06-09	-	-	-	-	8	20	-	-	2	24	-	-	10	44	-	-
10-13	-	-	-	-	11	23	-	-	2	35	-	5	13	58	-	5
14-17	-	-	-	-	15	24	-	-	3	53	-	1	18	77	-	1
18-21	-	-	-	2	1	17	-	-	4	65	-	7	5	82	-	9
22-25	-	1	-	1	-	9	-	1	-	55	2	7	-	65	2	9
26-29	-	8	1	4	-	11	-	3	2	36	-	6	2	55	1	13
30-33	1	5	-	4	-	3	-	1	1	10	-	2	2	18	-	7
34-37	-	1	-	1	-	-	-	-	-	2	-	-	-	3	-	1
6-37	1	15	1	12	35	107	-	5	14	280	2	28	50	402	3	45

1/ A single Grade 1 log, not included in this table, was 16 feet long, defective, and had a 31-inch scaling diameter.

Note: This table contains twenty-one 12-foot logs and thirty-two 14-foot logs.

Table 2.--Grade conversion table for 6/4-thickness lumber

Rough-dry grade	Percentage of lumber in surfaced-dry grade of--												Total portion 1/
	B & better	C select	D select	Moulding	No. 3 clear	1 shop	2 shop	3 shop	1 & 2 common	3 common	4 common	5 common	
B & btr.	60.1	05.4	33.5	--	--	--	--	--	--	--	--	--	99.0
C select	06.6	48.4	34.4	05.4	--	--	02.8	00.4	--	--	--	--	98.0
D select	--	02.4	73.7	16.1	--	02.5	03.7	--	--	02.3	01.3	--	102.0
Moulding	--	01.8	02.0	85.4	00.8	01.3	06.0	03.8	--	00.6	--	--	101.7
No. 3 clear	--	--	--	00.6	50.6	21.5	21.4	06.4	--	--	--	--	100.5
1 shop	--	--	--	--	00.9	58.8	36.1	05.0	--	--	01.2	--	102.0
2 shop	--	--	--	--	01.0	--	56.3	28.8	--	05.0	08.7	--	99.8
3 shop	--	--	00.3	00.4	--	01.0	05.2	82.3	--	--	07.7	04.1	101.0
1 & 2 com.	--	--	--	--	--	--	--	--	--	--	--	--	--
3 com.	--	--	--	--	--	--	--	--	--	88.8	11.1	--	99.9
4 com.	--	--	--	--	--	--	--	--	--	15.7	81.1	--	96.8
5 com.	--	--	--	--	--	--	--	--	--	--	--	--	--

1/ This column reflects the reduction in total volume from rough-dry to surfaced-dry grade. The boards to be planed were tallied according to their rough-dry, pencil-trimmed volume. Since these boards were not physically trimmed before planing, a gain of surfaced-dry footage was possible.

Table 3.--Grade conversion table for 4/4-thickness lumber

Rough-dry grade	Percentage of lumber in surfaced-dry grade of--													Total portion 1/
	B & better	C select	D select	Moulding	No. 3 clear	1 shop	2 shop	3 shop	1 & 2 common	3 common	4 common	5 common	Cull	
D select & btr.	01.1	08.5	42.5	31.1	02.4	06.3	--	--	--	--	03.2	--	--	95.1
Moulding	--	--	02.1	62.5	07.1	13.7	--	--	--	--	13.2	--	--	98.6
No. 3 clear	--	--	--	00.1	45.3	40.4	--	--	--	--	13.7	--	--	99.5
1 shop	--	--	--	01.2	01.5	50.7	09.7	--	--	--	36.0	--	--	99.1
2 shop	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3 shop	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1 & 2 com.	--	--	--	--	--	--	--	--	59.9	32.4	04.3	--	--	96.6
3 com.	--	--	--	--	--	--	--	--	03.3	75.7	17.0	00.2	--	96.2
4 com.	--	--	--	--	--	--	--	--	00.3	07.1	86.9	02.4	--	96.7
5 com.	--	--	--	--	--	--	--	--	--	--	04.4	90.8	04.1	99.3

1/ This column reflects the reduction in total volume from rough-dry to surfaced-dry grade.

Table 4.--Actual rough- and surfaced-dry lumber recovery and percent overrun for 402 sound 16-foot logs, by scaling diameter

Scaling diameter, inches	Number of logs	Log scale 1/	Lumber recovery		Overrun	
			Rough	Surfaced	Rough	Surfaced
	Number	Board feet			Percent	
6	1	20	17	16	-16	-19
7	10	300	333	323	11	7
8	14	420	567	549	35	31
9	19	760	1,038	1,005	37	32
10	19	1,140	1,242	1,203	9	5
11	15	1,050	1,214	1,175	16	12
12	10	800	1,051	1,017	31	27
13	14	1,400	1,710	1,656	22	18
14	15	1,650	2,078	2,013	26	22
15	16	2,240	2,625	2,545	17	14
16	21	3,360	3,960	3,844	18	14
17	25	4,500	5,514	5,010	14	11
18	16	3,360	3,544	3,449	5	3
19	23	5,520	5,702	5,564	3	1
20	21	5,880	5,800	5,669	-1	-4
21	22	6,600	6,645	6,515	1	-1
22	15	4,950	4,895	4,804	-1	-3
23	17	6,460	6,141	6,022	-5	-7
24	17	6,800	6,625	6,515	-2	-4
25	16	7,360	6,648	6,539	-10	-11
26	15	7,500	6,881	6,790	-8	-9
27	19	10,450	9,063	8,952	-13	-14
28	12	6,960	6,279	6,207	-10	-11
29	9	5,490	5,104	5,045	-7	-8
30	7	4,620	4,313	4,267	-7	-8
31	5	3,550	3,144	3,114	-11	-12
32	3	2,220	2,164	2,143	-2	-3
33	3	2,340	2,212	2,206	-5	-6
34	2	1,600	1,534	1,526	-4	-5
35	0					
36	1	920	927	924	+1	0
Total	402	110,220	108,610	106,607	-1.5	-3.3

1/ Scaled by Scribner Decimal C Log Rule.

Table 5.--Estimated (curved) rough- and surfaced-dry lumber recovery and percent overrun for 402 sound 16-foot logs, by scaling diameter

Scaling diameter, inches	Number of logs	Log scale 1/	Lumber recovery		Overrun	
			Rough	Surfaced	Rough	Surfaced
	Number	Board feet			Percent	
6	1	20	23.7	24.0	18	20
7	10	30	33.6	33.1	12	10
8	14	30	44.6	43.4	49	45
9	19	40	56.9	55.1	42	38
10	19	60	70.5	68.0	18	13
11	15	70	85.3	82.3	22	18
12	10	80	101.3	97.8	27	22
13	14	100	118.6	114.6	19	15
14	15	110	137.2	132.7	25	21
15	16	140	157.0	152.1	12	9
16	21	160	178.0	172.8	11	8
17	25	180	200.3	194.8	11	8
18	16	210	223.9	218.1	7	4
19	23	240	248.6	242.6	4	1
20	21	280	274.7	268.5	-2	-4
21	22	300	302.0	295.6	1	-1
22	15	330	330.5	324.1	0	-2
23	17	380	360.3	353.8	-5	-7
24	17	400	391.4	384.8	-2	-4
25	16	460	423.6	417.2	-8	-9
26	15	500	457.2	450.8	-8	-10
27	19	550	492.0	485.7	-10	-12
28	12	580	528.0	521.8	-9	-10
29	9	610	565.3	559.3	-7	-8
30	7	660	603.8	598.1	-8	-9
31	5	710	643.6	638.2	-9	-10
32	3	740	684.6	679.5	-7	-8
33	3	780	726.9	722.1	-7	-7
34	2	800	770.4	766.1	-4	-4
35	0	880	815.2	811.3	-7	-8
36	1	920	861.2	857.8	-6	-7

1/ Scaled by Scribner Decimal C Log Rule.

Table 6.--Rough-dry lumber-grade recovery, by California Westside log grade (field) and diameter class

Log scaling diameter class, inches	Lumber grade yields in percent-- B & better	C select	D select	Mould-ing	No. 3 clear	1 shop	2 shop	3 shop	1 & 2 common	3 common	4 common	5 common	Cull	Total
Log Grade II[1/]														
18-21	--	00.5	01.8	10.2	08.8	16.3	04.2	07.9	--	05.2	29.2	14.1	01.9	100.0
22-25	02.3	06.7	05.8	08.6	03.5	09.4	15.3	02.2	--	01.6	32.5	10.6	01.5	100.0
26-29	03.8	03.9	10.8	20.8	05.1	10.3	09.7	04.6	00.4	07.2	20.4	02.5	00.5	100.0
30-33	02.0	05.9	10.2	28.2	05.3	10.1	09.5	04.1	00.5	06.4	14.5	02.5	00.8	100.0
34-37	00.5	04.9	11.7	22.4	03.9	15.4	11.4	03.5	01.6	11.6	13.1	--	--	100.0
All	02.6	04.8	10.1	23.0	05.1	10.9	09.9	04.3	00.5	07.0	18.1	03.0	00.7	100.0
Log Grade III														
06-09	--	01.0	00.3	00.5	00.4	00.8	--	--	28.4	45.2	17.7	04.8	00.9	100.0
10-13	--	--	00.5	00.8	00.6	01.4	00.2	--	34.9	48.6	12.1	00.7	00.2	100.0
14-17	--	00.1	00.6	00.5	01.7	02.3	01.4	00.1	38.1	43.3	09.6	02.1	00.2	100.0
18-21	00.2	00.5	00.8	01.2	04.3	06.0	04.8	00.1	26.3	38.3	17.1	00.4	--	100.0
22-25	00.3	02.0	05.5	06.7	04.8	11.2	10.8	03.7	04.7	27.0	22.2	01.3	00.1	100.0
26-29	00.1	02.2	06.3	16.9	06.7	13.0	12.2	03.6	03.3	12.3	19.5	03.6	00.3	100.0
30-33	00.7	05.2	02.4	18.8	06.2	15.2	07.9	05.6	00.6	12.0	22.4	02.4	00.6	100.0
All	00.2	01.4	02.8	07.2	04.0	07.7	06.2	01.9	19.2	30.6	16.6	02.0	00.2	100.0
Log Grade IV														
06-09	--	--	--	00.6	--	01.0	03.1	--	30.5	42.9	15.6	05.2	01.1	100.0
10-13	--	--	--	00.8	00.6	00.7	00.3	--	30.0	41.6	23.0	02.7	00.3	100.0
14-17	00.2	--	00.5	01.5	03.1	04.0	01.0	00.2	29.9	40.5	16.7	02.0	00.4	100.0
18-21	00.2	00.6	01.9	03.6	06.3	08.1	06.7	02.2	13.4	35.7	20.0	01.2	00.1	100.0
22-25	00.3	01.0	02.8	04.9	06.6	10.9	13.2	03.2	08.4	26.9	20.3	01.3	00.2	100.0
26-29	00.9	01.2	04.0	09.3	09.5	13.1	13.3	02.7	06.5	21.0	16.5	01.8	00.2	100.0
30-33	01.4	01.9	04.9	12.5	06.9	14.0	16.1	02.6	04.0	14.7	19.2	01.6	00.2	100.0
34-37	02.8	02.1	10.2	28.3	11.0	12.4	09.4	00.5	02.6	05.5	14.6	00.4	00.2	100.0
All	00.5	00.9	02.8	06.2	06.6	09.8	09.9	02.3	12.1	28.3	18.8	01.6	00.2	100.0

1/ Log Grade I omitted because only one log sampled.

Table 7.--Surfaced-dry lumber-grade recovery, by California Westside log grade (field) and diameter class

Log scaling diameter class, inches	Lumber grade yields in percent--												
	B & better	C select	D select	Mould-ing	No. 3 clear	1 shop	2 shop	3 shop	1 & 2 common	3 common	4 common	5 common	Total
						Log Grade II[1]							
18-21	00.2	00.6	01.4	09.1	04.7	12.9	09.0	09.1	00.2	07.1	31.4	14.3	100.0
22-25	01.5	03.1	07.8	09.4	02.2	07.2	12.9	07.2	00.1	05.1	32.9	10.6	100.0
26-29	01.8	03.9	09.7	20.0	03.1	08.6	10.7	07.9	00.5	08.3	22.5	03.0	100.0
30-33	01.8	04.0	09.7	26.1	03.3	08.7	10.9	07.7	00.5	07.2	17.3	02.8	100.0
34-37	01.7	03.7	09.0	21.0	02.6	11.0	12.9	07.6	01.3	11.5	17.3	00.4	100.0
All	01.7	03.8	09.3	21.6	03.2	09.0	11.0	07.8	00.6	08.0	20.6	03.4	100.0
						Log Grade III							
06-09	00.1	00.3	00.7	00.6	00.2	00.7	00.3	--	19.1	47.9	25.2	04.9	100.0
10-13	--	00.1	00.3	00.8	00.3	01.1	00.6	00.2	23.1	51.8	20.7	01.0	100.0
14-17	00.1	00.2	00.4	00.5	00.9	01.9	01.7	00.7	24.9	48.5	18.0	02.2	100.0
18-21	00.1	00.3	00.7	01.3	02.2	05.0	05.0	01.9	17.4	41.1	24.2	00.8	100.0
22-25	00.8	01.6	04.0	06.8	02.7	08.4	10.5	07.0	03.7	25.6	27.3	01.6	100.0
26-29	00.8	02.0	04.7	15.3	03.8	10.3	12.5	07.8	02.4	13.3	23.2	03.9	100.0
30-33	00.8	01.9	04.6	16.9	03.6	11.6	10.9	08.3	00.8	12.2	25.5	02.9	100.0
All	00.4	01.0	02.4	06.7	02.2	06.1	06.7	04.1	12.7	32.5	22.8	02.4	100.0
						Log Grade IV							
06-09	--	--	--	00.6	--	00.6	02.1	01.0	20.4	46.7	23.2	05.4	100.0
10-13	--	--	--	00.6	00.3	00.6	00.5	00.2	19.9	45.7	29.1	03.1	100.0
14-17	00.1	00.2	00.4	01.4	01.6	03.5	02.1	00.8	19.7	44.1	23.8	02.3	100.0
18-21	00.3	00.6	01.4	03.5	03.3	06.9	07.1	04.4	09.3	35.0	26.5	01.7	100.0
22-25	00.4	00.9	02.2	04.7	03.6	08.7	11.8	07.3	05.9	26.6	26.1	01.8	100.0
26-29	00.6	01.3	03.3	08.7	05.0	11.0	13.0	07.2	04.6	20.9	22.2	02.2	100.0
30-33	00.8	01.8	04.4	11.6	03.9	10.8	14.8	08.0	02.9	15.5	23.5	02.0	100.0
34-37	01.5	03.4	08.1	25.6	06.0	11.8	11.6	04.9	01.8	07.1	17.6	00.6	100.0
All	00.4	00.9	02.3	05.8	03.5	08.1	09.7	05.6	08.3	28.7	24.7	02.0	100.0

1/ Log Grade I omitted because only one log sampled.